UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
School of Computer Science and Applied Mathematics

Optimisation II
Course Description 2018

1 Staff Members

Course Coordinator: Dr Adewunmi Fareo

Lecturer: Dr Matthew Woolway

Room Number: UG3 (Maths Sciences Building - MSB)

Email: matthew.woolway@wits.ac.za

2 Timetable for Lectures and Tutorials

There will be **two** lecture periods per week:

- Monday: 08:00-09:45 **Venue:** P115
- Tuesday: 12:30-14:15 **Consultation/Tutorial:** UG3

3 Course Background, Goals and Outcomes

This course is designed to introduce nonlinear optimisation to second year applied mathematics students. We cover the basic theories of nonlinear univariate and multivariate optimisation. A special emphasis is given to the derivation of numerical algorithms for solving practical problems. The objectives of the course are:

3.1. To understand the fundamental concepts and be able to formulate nonlinear optimisation problems.

3.2. To derive and discuss a number of methods to solve unconstrained and bound constrained nonlinear univariate optimisation problems analytically or numerically.

3.3. To characterise maxima (or minima) and implement numerical algorithms to solve multivariate unconstrained optimisation problems.

4 Syllabus

- Definitions and general concepts of Optimisation
- Unconstrained and bound constrained problems in one dimension
- Numerical differentiation and solutions to nonlinear equations
- Numerical optimisation of univariate functions
- Multivariate unconstrained optimisation
- Gradient methods for unconstrained optimisation
- Newton and Quasi-Newton methods
- Direct search methods for unconstrained problems
- Lagrangian multipliers for constraint optimisation

5 Assessment

There will be two tests, a set of labs and a final examination.

Thus, the final course mark is made up as follows:

- Continuous Assessment 40%
  - Consisting of 2 tests and several labs
- Final Examination 60%

No student may miss both tests.

The language used for the programming component of the course is Python.

NB! I must stress the importance of developing strong programming and computational skills!

6 Other Information

Textbooks and Required Reading: There is no set textbook for this course. The handed out material will cover all required coursework. However, you are encouraged to make use of the library for additional resources on optimisation and methods. The Geomaths library has ample resources for your perusal.